

Air Force Institute of Technology

Integrity - Service - Excellence

Critical Chain Project Management

**Lt Col Stephen M.
Swartz, Ph.D.
AFIT/ENS**



U.S. AIR FORCE



U.S. AIR FORCE

Objective

- **Introduce project management concepts and tools that:**
 - **Support effective decision-making at all levels**
 - **Dramatically improve bottom-line performance**
 - **Enhance the quality of life for people in the organization**

Critical Chain Project Management

Integrity - Service - Excellence



Bottom Line Results

U.S. AIR FORCE

- **Harris Semiconductor**
 - **Applied critical chain to building a fabrication plant that generates \$2 million in revenue a DAY. Plant was done 34 MONTHS early.**
- **Israeli Air Force**
 - **Reduced average time for aircraft on ground (for repairs) from 3 months to 2 weeks.**



Bottom Line Results

U.S. AIR FORCE

- **\$500M product development organization**
 - **Increased on-time performance to nearly 100%.**
 - **Significant increase in productivity.**
 - **Significant reduction in cycle time.**
 - **Viewed as a competitive advantage.**
- **Edwards Flight Test Center**
 - **Scheduled for early completion.**
 - **Quality of life improvements.**
 - **Saved program \$**
 - **“...the tool gives management better focus & more confidence...”**

Integrity - Service - Excellence



U.S. AIR FORCE

Critical Chain Project Management

Integrity - Service - Excellence



U.S. AIR FORCE

Common Project Management Tools

- **Informal systems**
- **Gantt charting**
- **PERT/CPM**
- **Earned Value**



U.S. AIR FORCE

CPM/EVM Practices

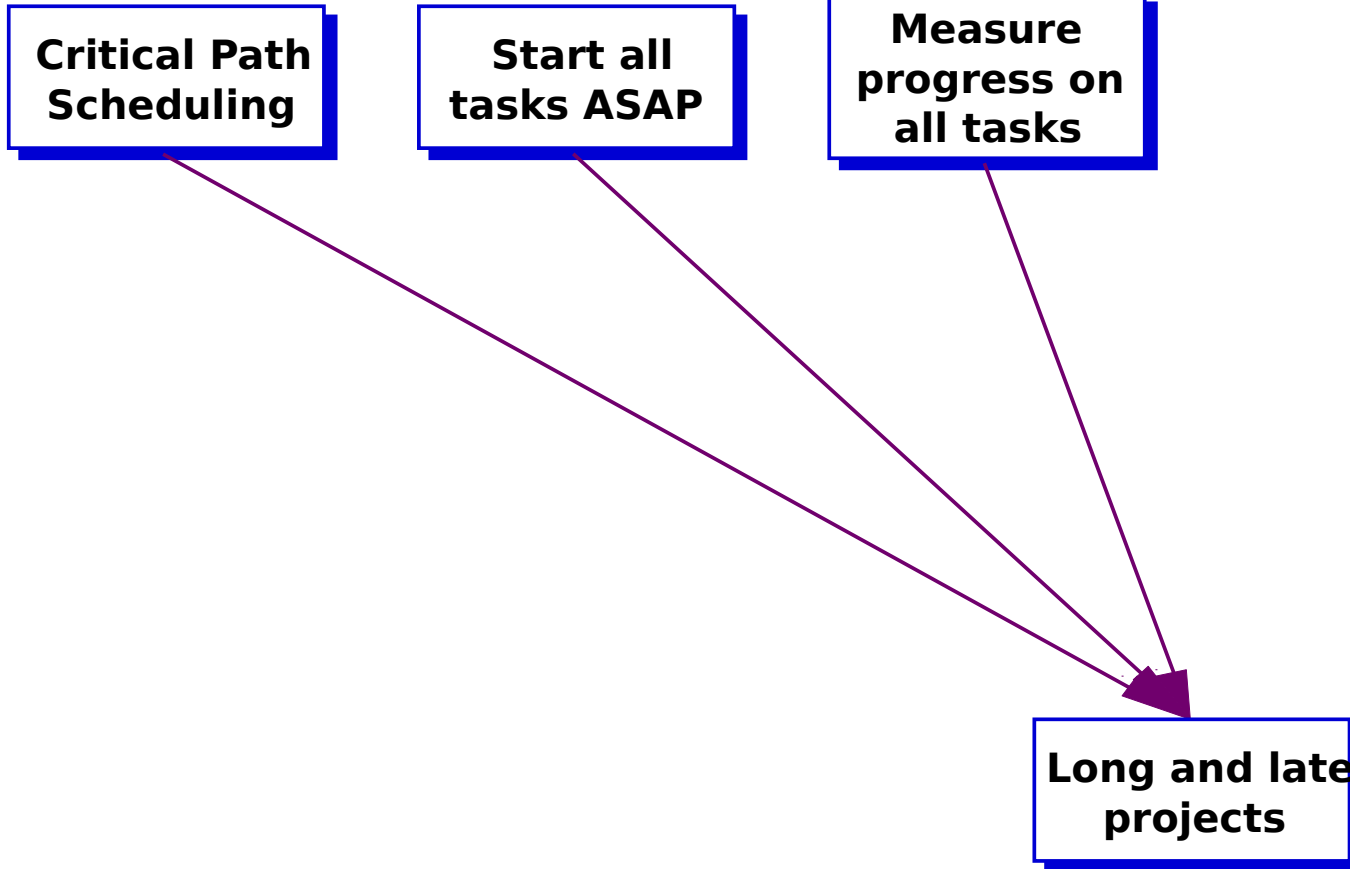
The State of the Art

- **Schedule using Critical Path method**
- **Use early start schedules**
- **Measure and report progress on all tasks**



U.S. AIR FORCE

The Impact of a CPM/EVM System

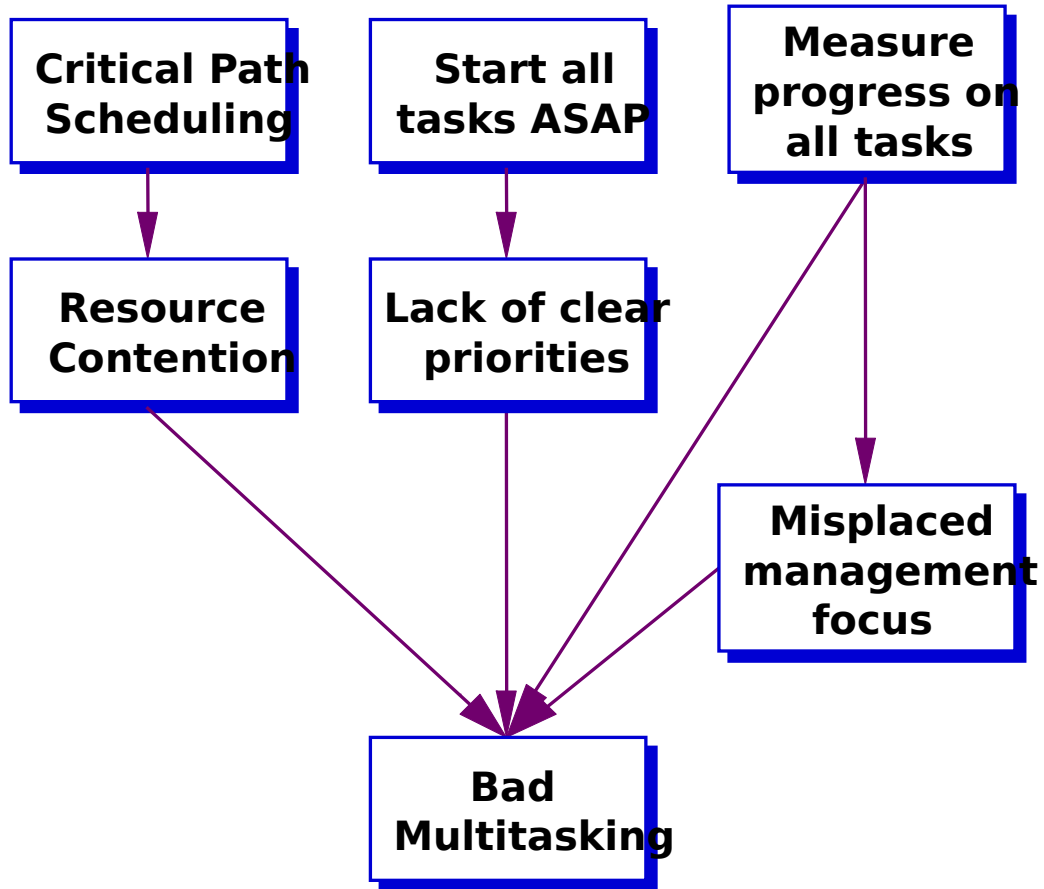


Integrity - Service - Excellence



U.S. AIR FORCE

The Impact of a CPM/EVM System

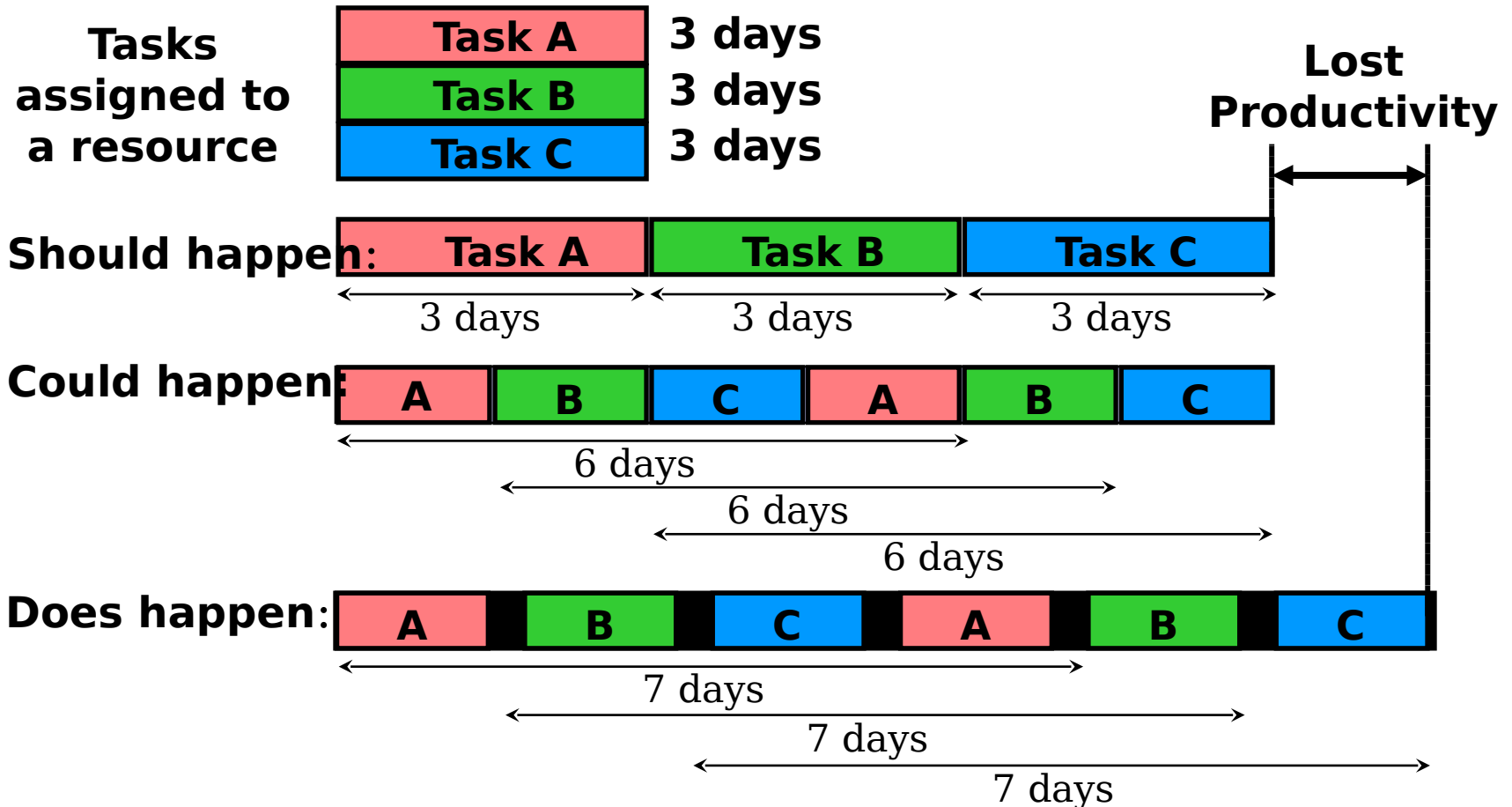


Integrity - Service - Excellence



U.S. AIR FORCE

Bad Multitasking

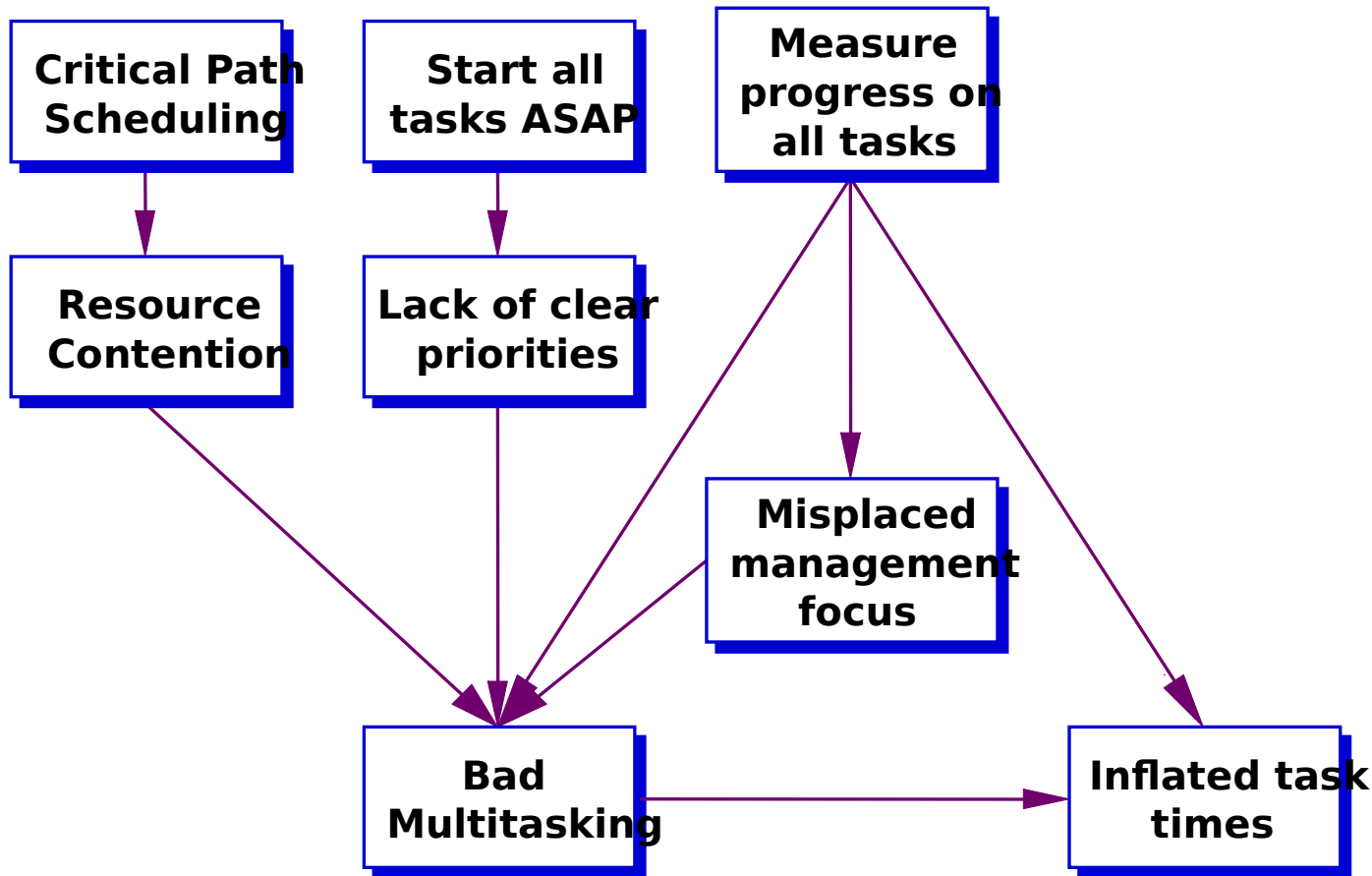


Integrity - Service - Excellence



U.S. AIR FORCE

The Impact of a CPM/EVM System

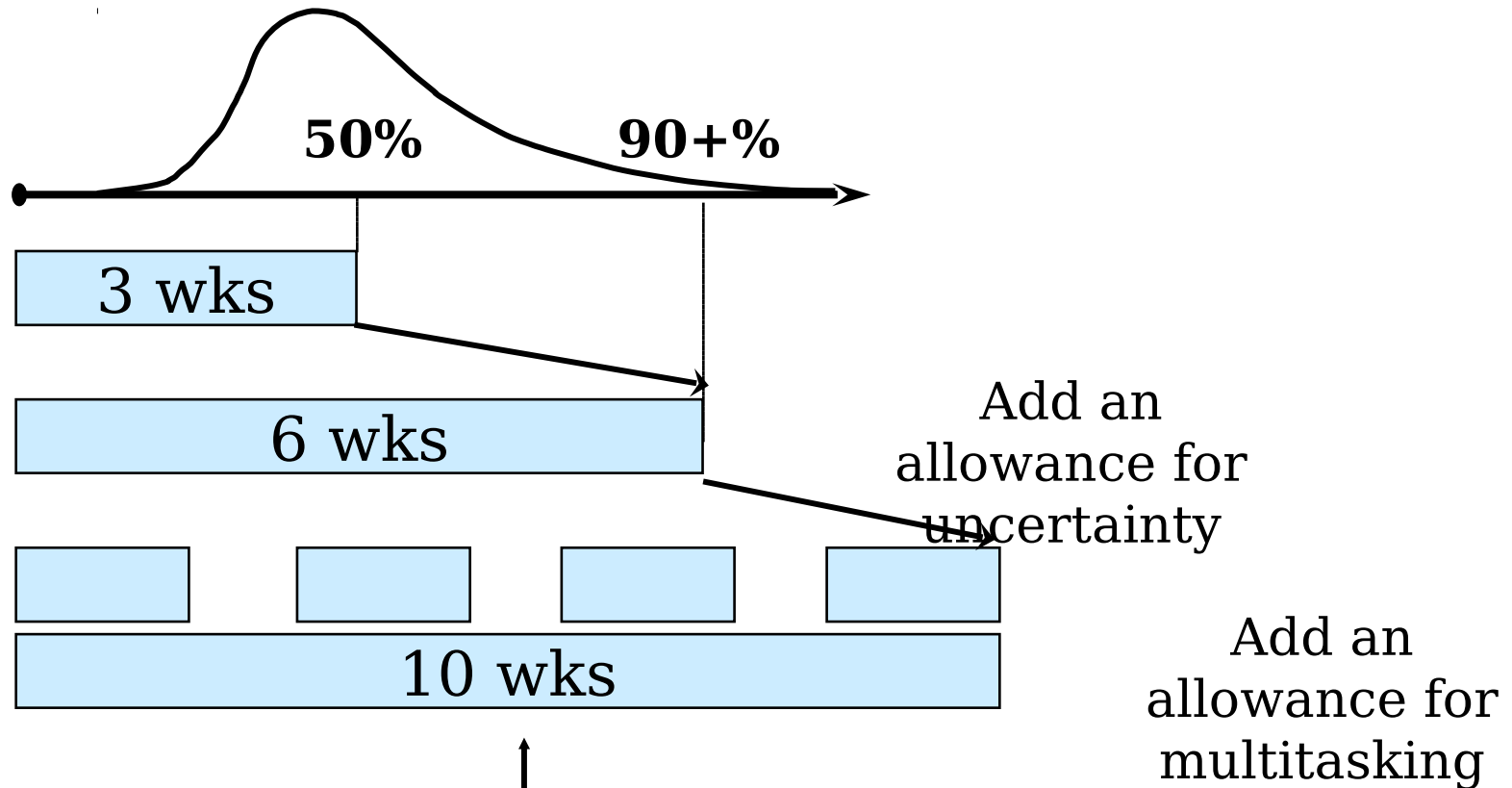


Integrity - Service - Excellence



U.S. AIR FORCE

Estimating Task Times

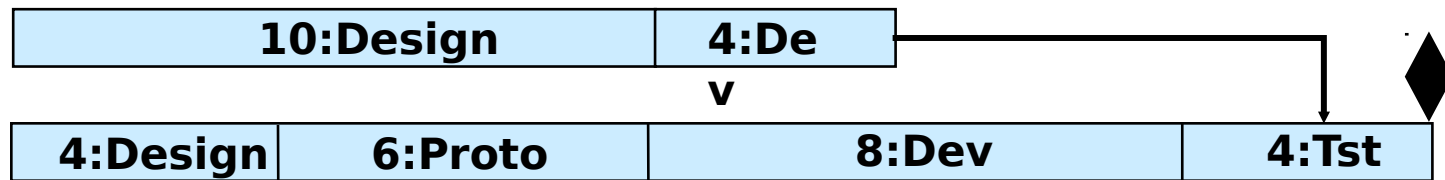


These are the estimates that usually go into our project schedules



U.S. AIR FORCE

A CPM Project Schedule



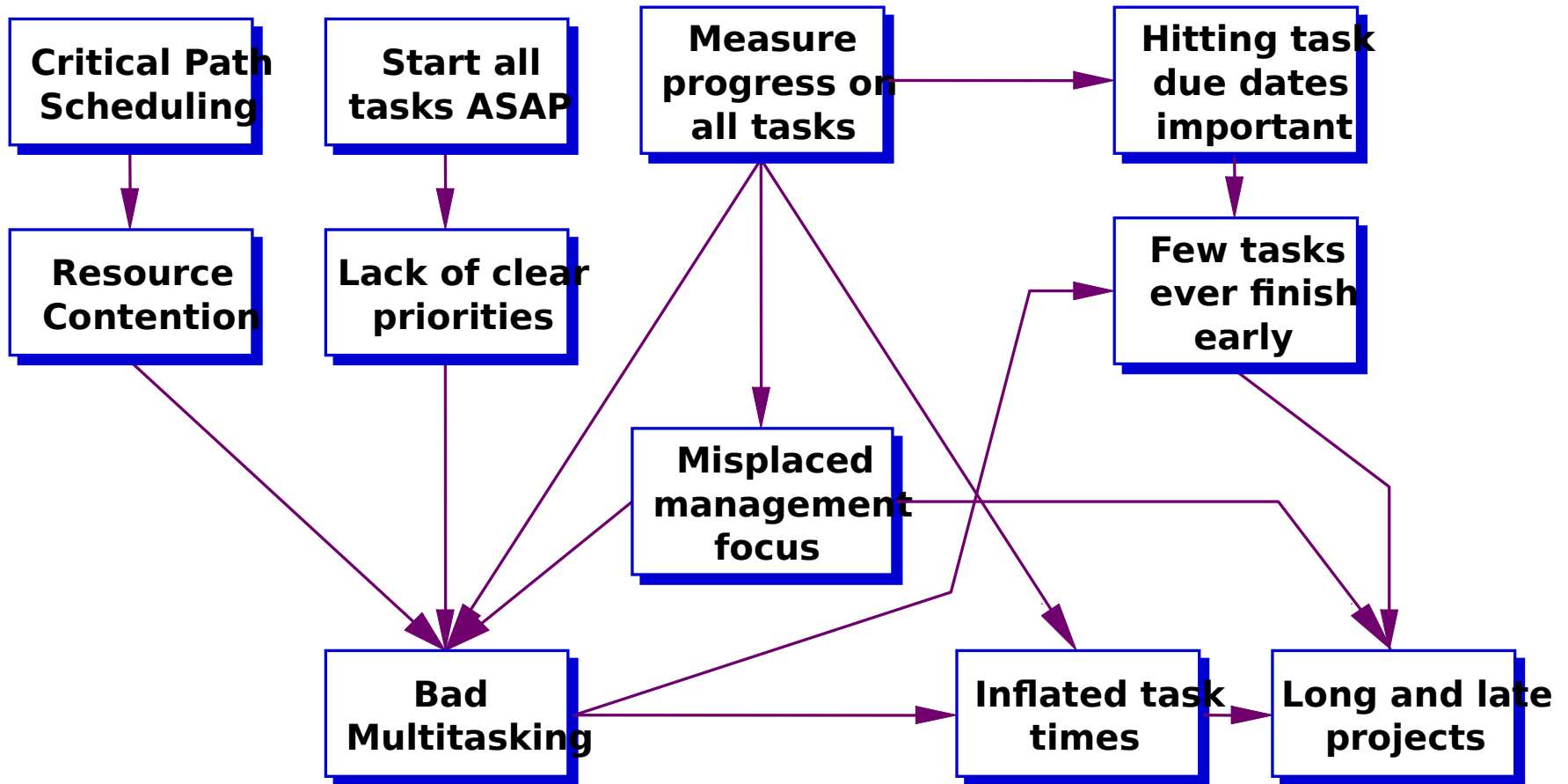
Time Estimate:Resource

- **Padded task times**
- **Early start schedule**
- **Unresolved resource contention**



U.S. AIR FORCE

The Impact of a CPM/EVM System



Integrity - Service - Excellence



U.S. AIR FORCE

The Critical Chain Approach

- **Resolve resource contention**
- **Pace the start of new work**
- **Focus attention on global measures**
- **Set clear priorities**
- **Pull padding from tasks and aggregate protection for project**

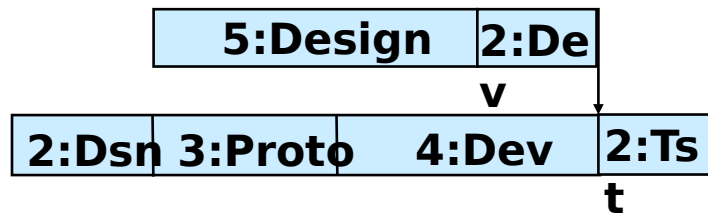
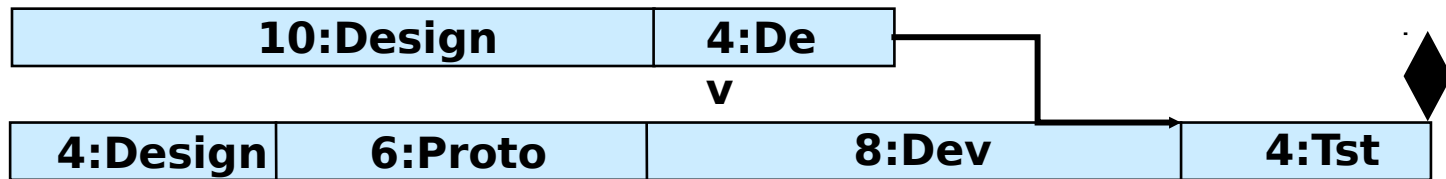


U.S. AIR FORCE

Step 1: Create the Network

A.) Use average task times

B.) Place tasks at late start

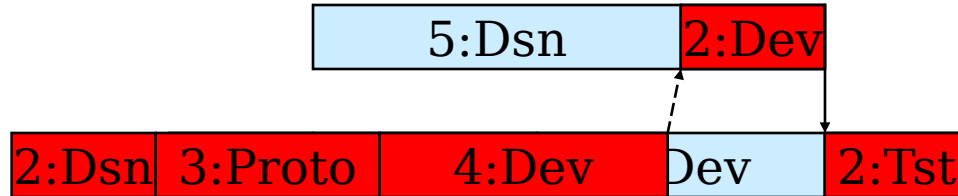




U.S. AIR FORCE

Step 2: Identify the Critical Chain

A.) Eliminate resource contention



B.) Identify the Critical Chain

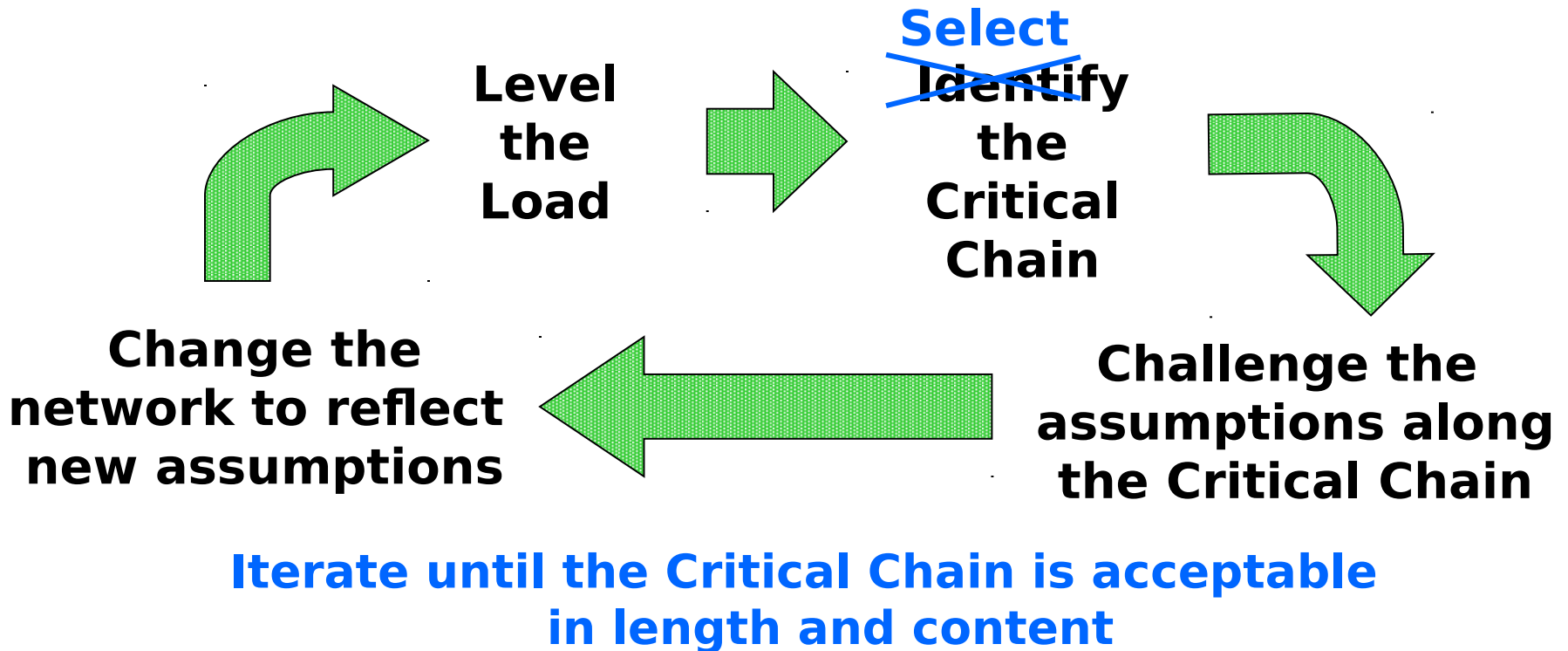
The Critical Chain

The longest path through the network considering both **task** and **resource** dependencies



U.S. AIR FORCE

Focused Project Cycle Time Reduction

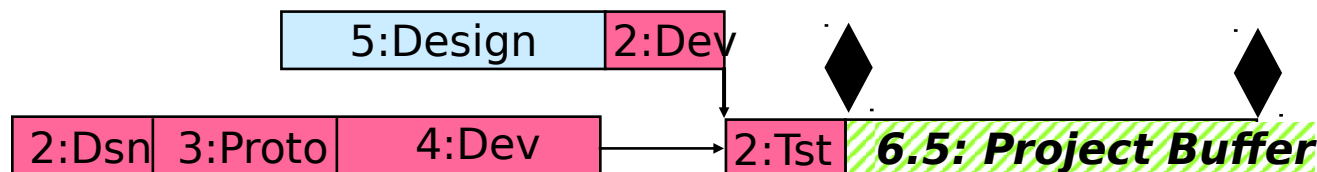




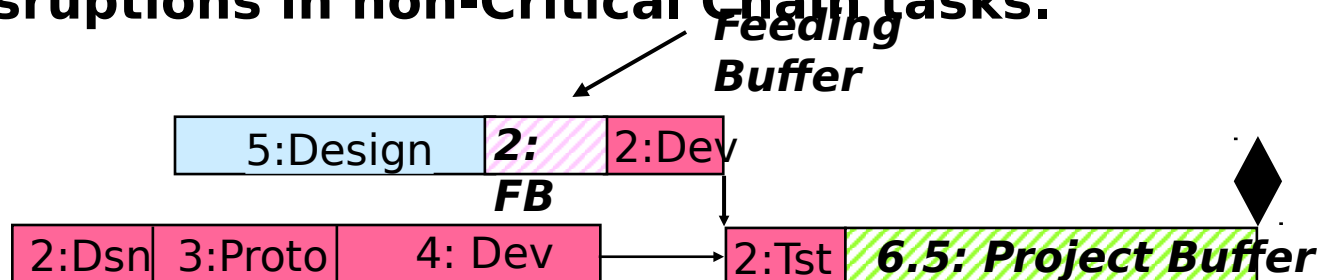
U.S. AIR FORCE

Step 3: Deal with Uncertainty

- What is the chance of completing when “planned”?
- The *Project Buffer* protects the project due date from disruptions along the Critical Chain.



- Where else is the project vulnerable to disruptions?
- *Feeding buffers* protect the Critical Chain from disruptions in non-Critical Chain tasks.



Integrity - Service - Excellence



U.S. AIR FORCE

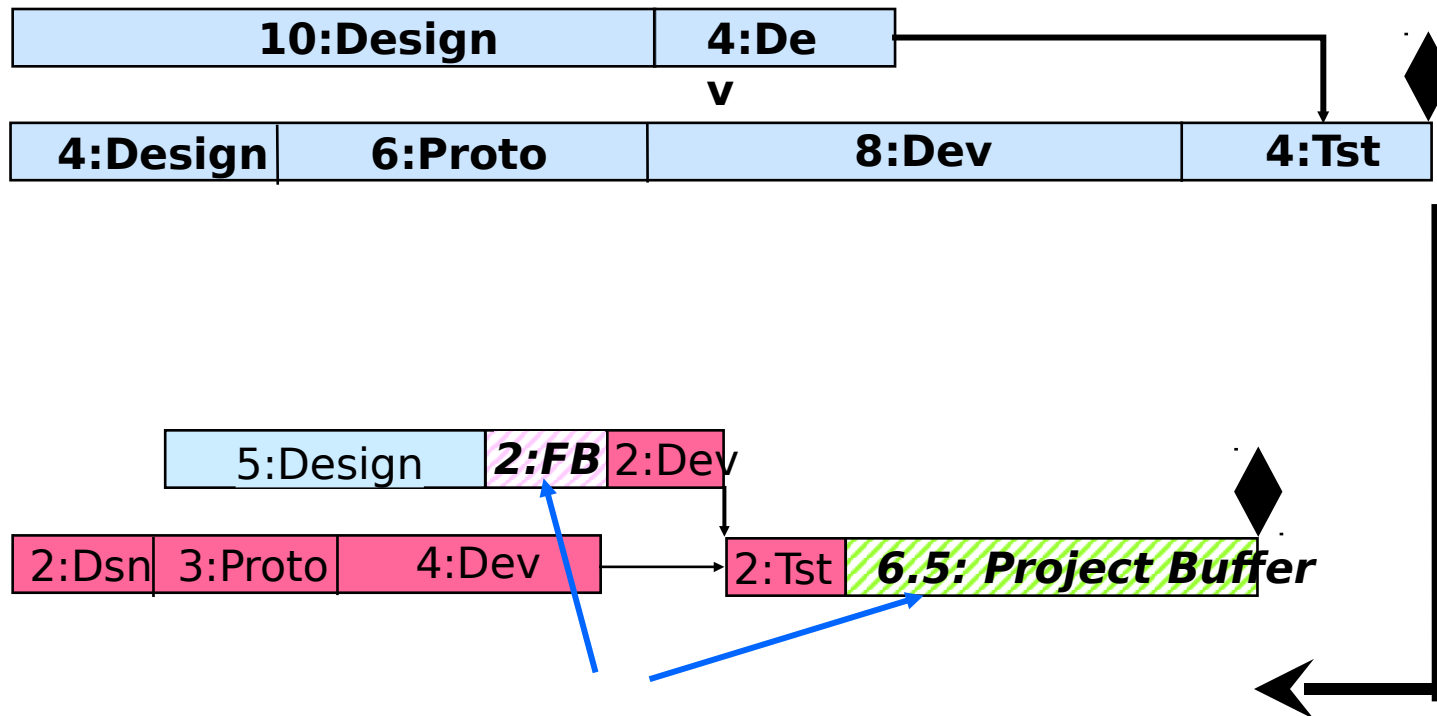
The Last Word on Protection

- Buffers protect *the entire project*, not individual tasks
 - Less time provides the same level of protection
- Buffers are *essential* elements of the schedule
 - Buffers \neq Management Reserve



U.S. AIR FORCE

The Difference



Better Protected Shorter Project



U.S. AIR FORCE

Step 4: Finalize the Plan & Begin

- **Operating Rules**
 - **Start tasks without predecessors on schedule**
 - **Set clear and stable priorities**
 - **CC first**
 - **Others FCFS unless changed by management**
 - **Reduce multitasking**
- **Update task status regularly**
 - **Days of work remaining**
- **Use buffer status to focus attention and energies**

Integrity - Service - Excellence

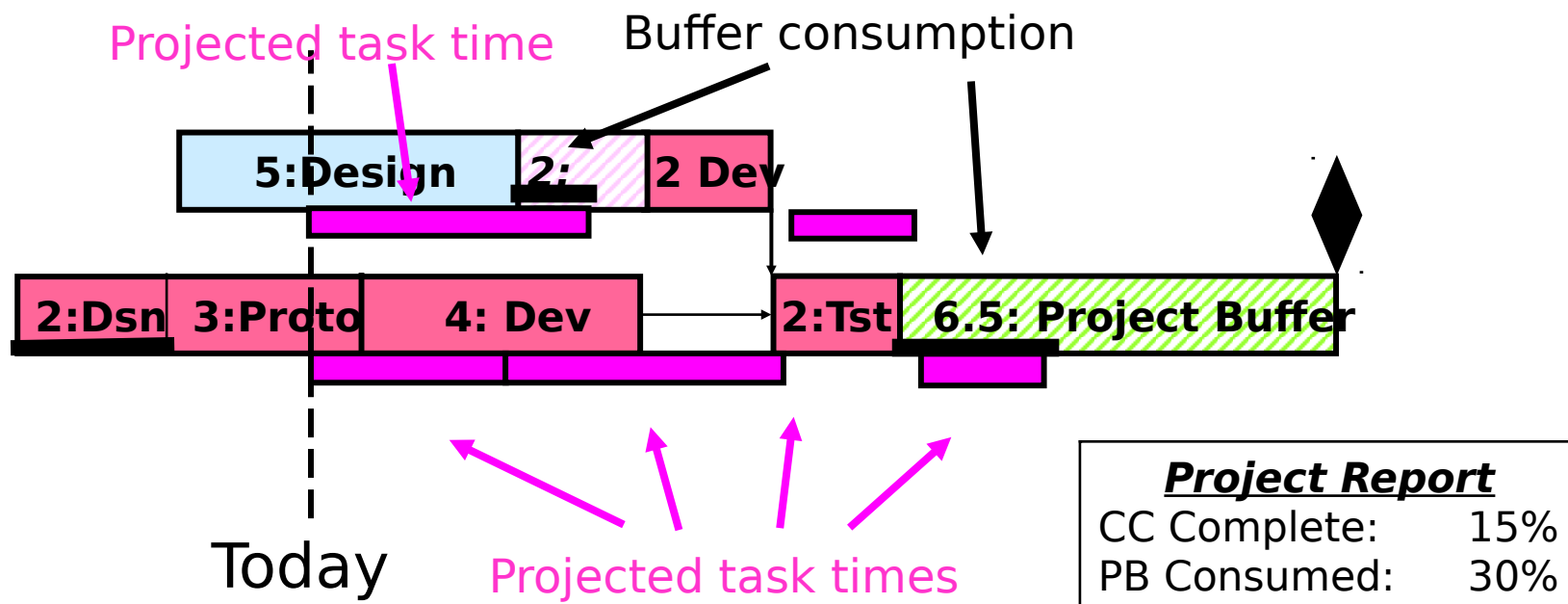


U.S. AIR FORCE

Updating Tasks

Design: “We completed the 2-day task, but we still have 4 days to go on

Protocol: “We haven’t had a chance to get to our task”





U.S. AIR FORCE

Project Manager Decision ***Support***

CCPM enables the project managers to know where to focus attention

Buffer Report

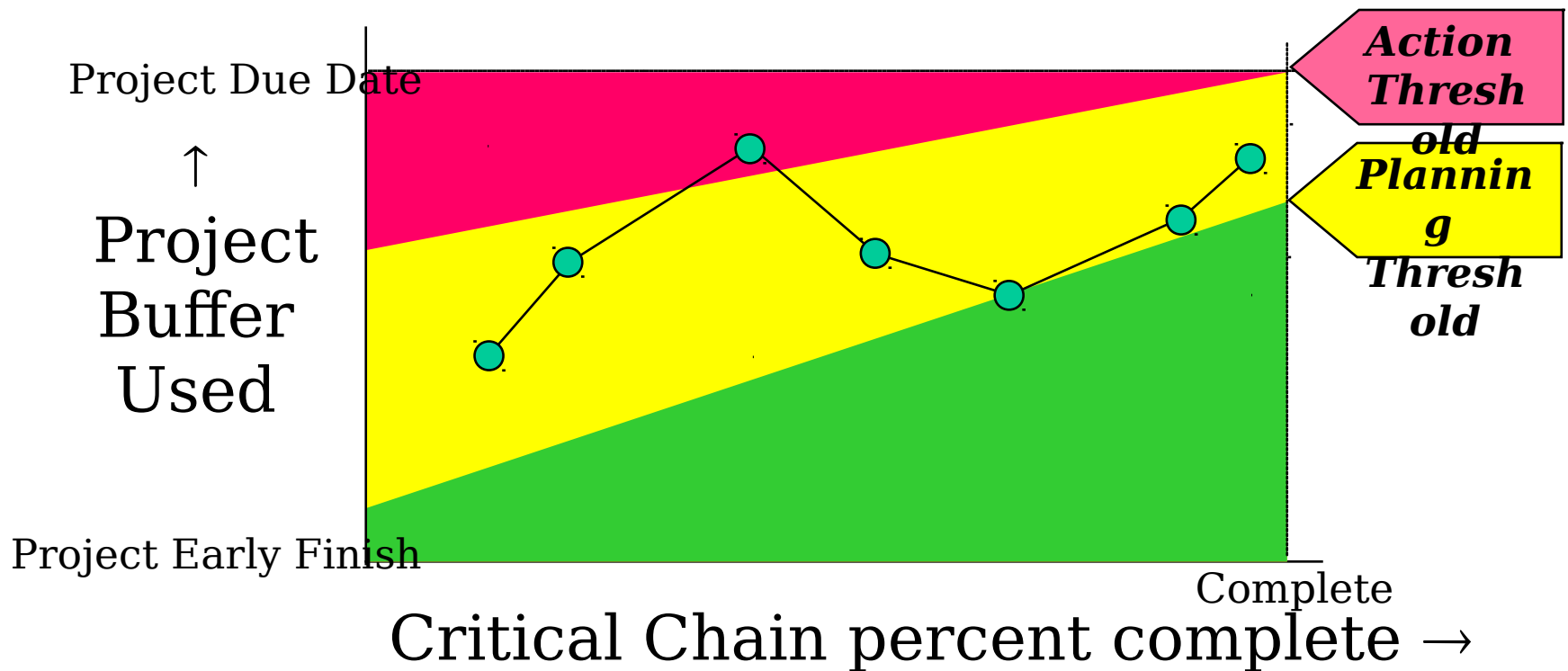
<u>Risk Buffer</u>	<u>Consumed</u>	<u>Look at . . .</u>
Feeding A	90%	Task 2.2.4
Feeding B	38%	Task 3.1.1
Project	20%	Task 1.2.2
	30%	Critical Chain



U.S. AIR FORCE

Executive Decision Support

CCPM provides leaders real-time information on project status allowing them to focus their attention and resources



Integrity - Service - Excellence



U.S. AIR FORCE

Resource Manager Decision Support

CCPM enables the resource manager to set priorities across projects based on the needs of the organization.

Resource: Engineering

<u>Tasks Available to Work</u>	<u>Project Impact If</u>	<u>Priori</u>
Project C, Task 1.2.1	<u>Delayed</u>	<u>ty</u>
Project A, Task 3.5.1	High	2
Project C, Task 1.2.4	Medium	3
	Very High	1

Integrity - Service - Excellence



U.S. AIR FORCE

The Single Project Solution

- **Within a project**
 - **Resolves resource contention**
 - **Starts tasks when they need to be started**
 - **Provides clear priorities**
 - **CC first**
 - **Others FCFS unless changed by management**
 - **Shifts focus from tasks to project**
- **What about multi-project organizations?**



U.S. AIR FORCE

The Multi-Project Solution

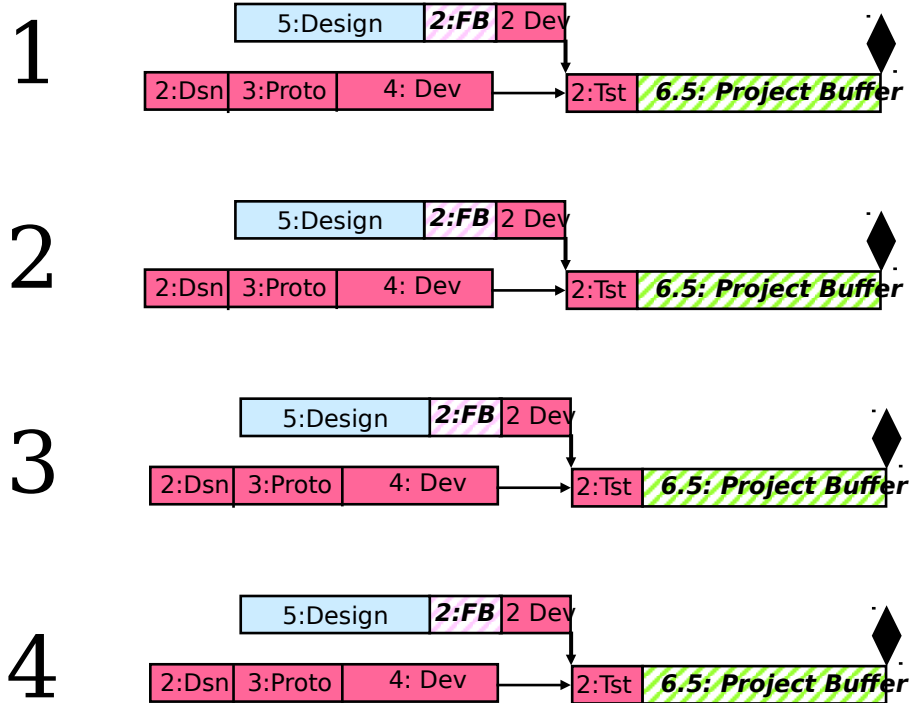
- **Schedule individual projects using critical chain**
- **Determine the timing of individual projects using a drum schedule**
 - **Resolve resource contention on the most heavily loaded resource across all projects**
 - **Paces the start of new projects**

Integrity - Service - Excellence



U.S. AIR FORCE

Starting New Projects



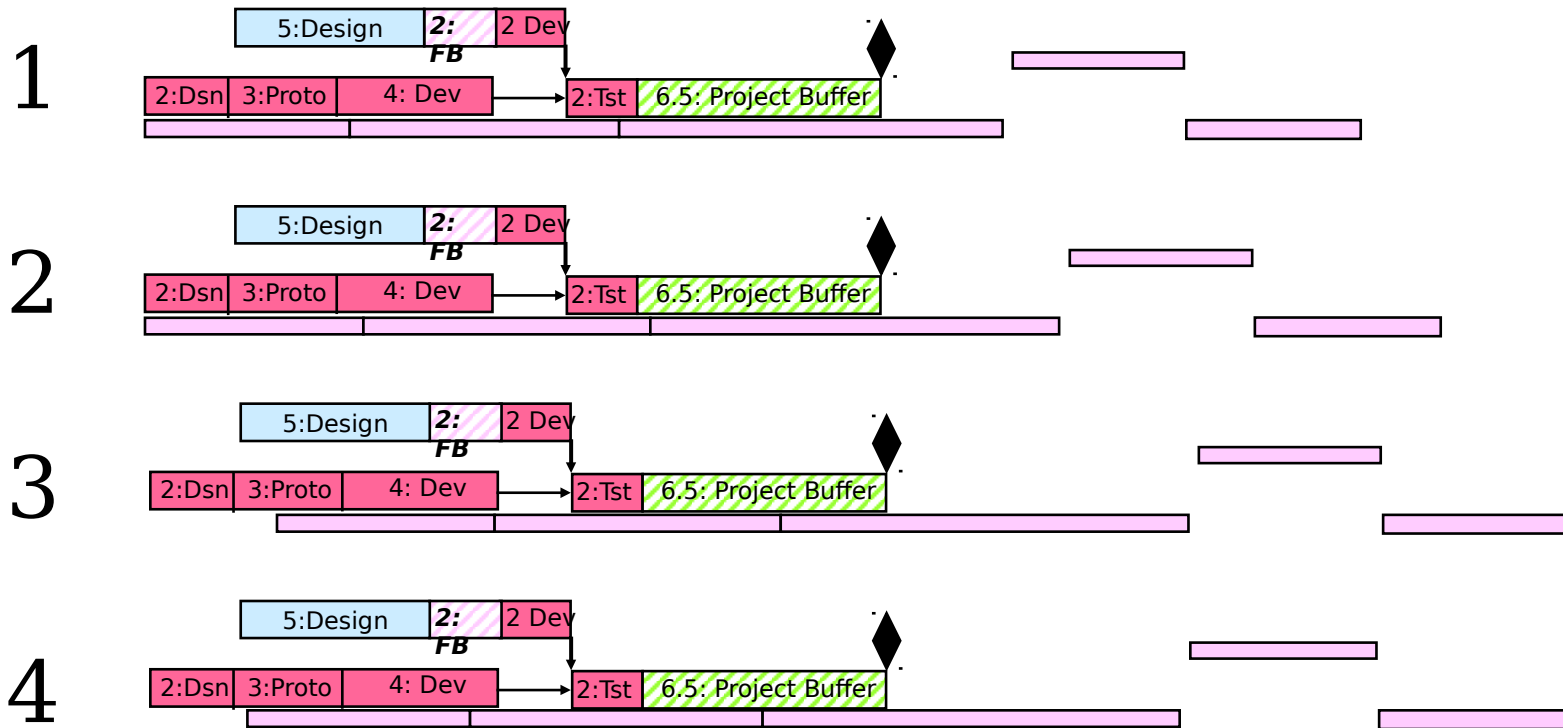
Integrity - Service - Excellence



U.S. AIR FORCE

Start All Projects ASAP?

...“ASAP” leads to bad Multi-Tasking



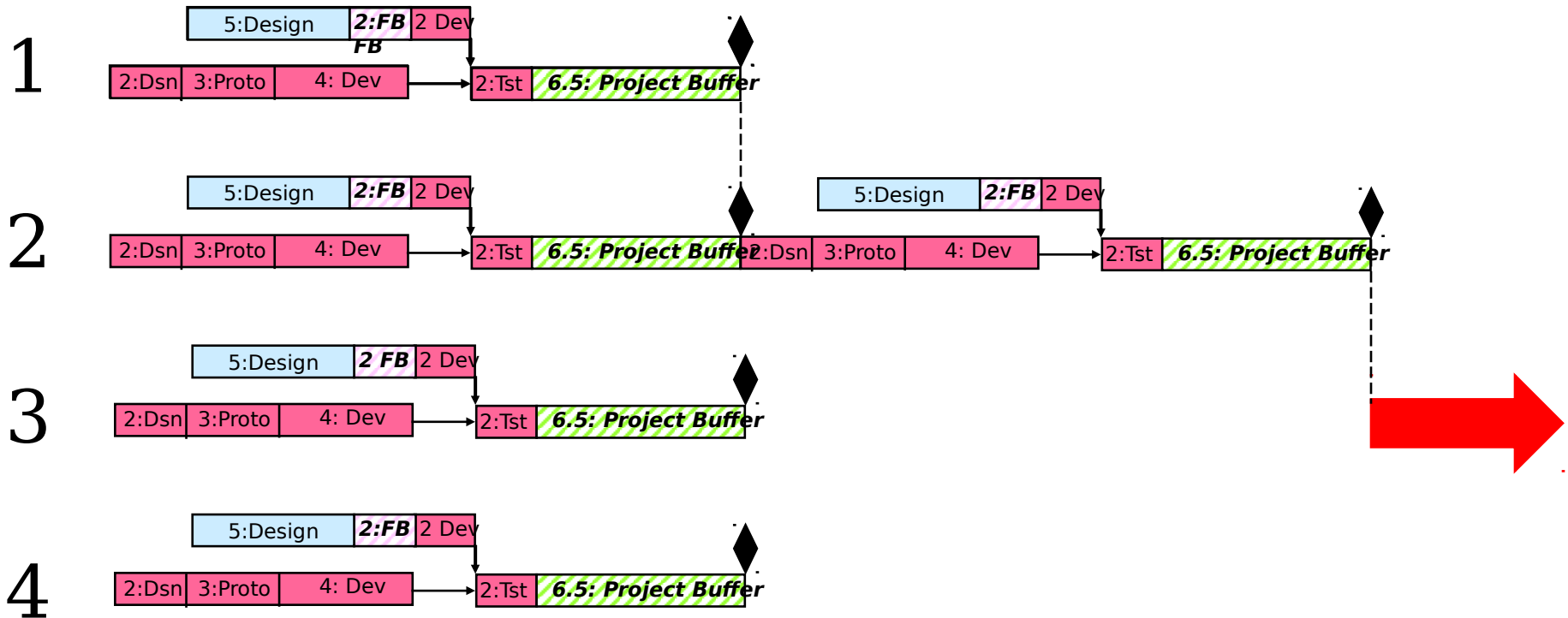
Integrity - Service - Excellence



U.S. AIR FORCE

One After the Other?

...one after the other makes them too late



Integrity - Service - Excellence



The Critical Chain Solution

U.S. AIR FORCE

- **Start projects based on**
 - **When the projects are due**
 - **The capacity of the organization**
- **Capacity is determined by the most constrained resource or department**

*A chain is only as strong
as its weakest link!*

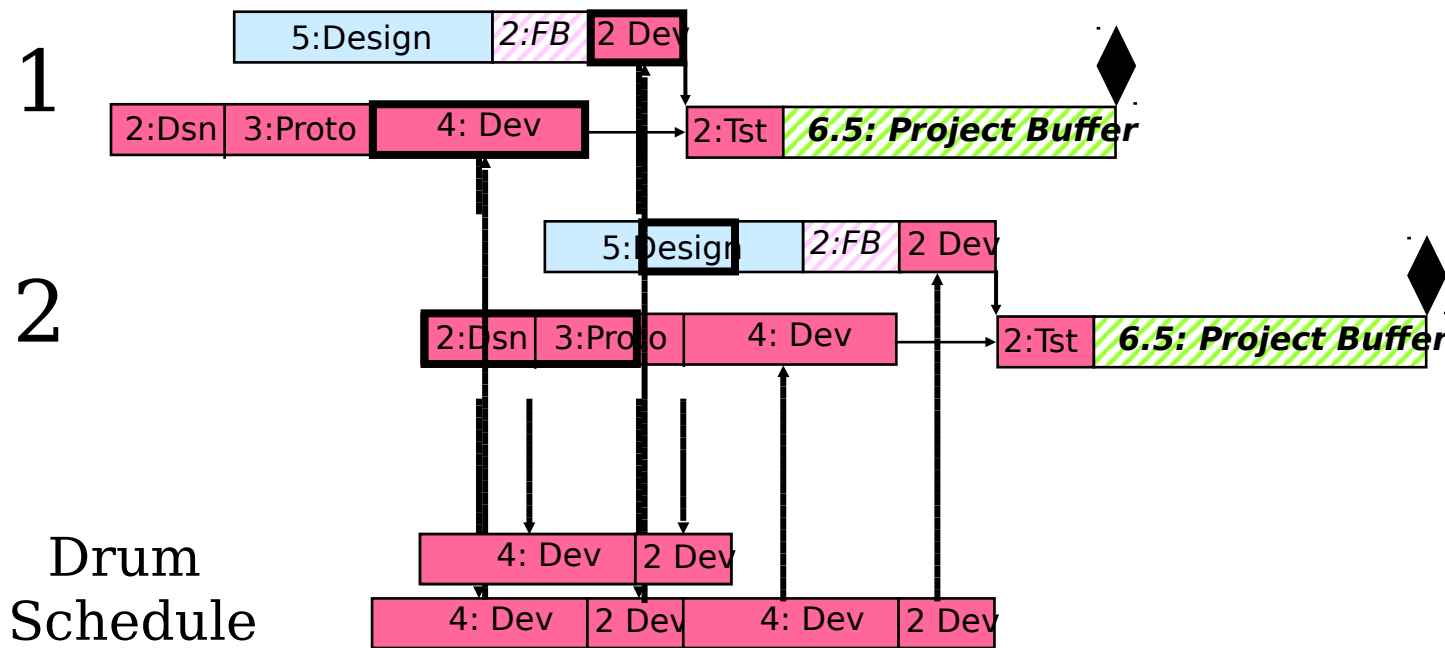
Integrity - Service - Excellence



U.S. AIR FORCE

Multi-Project Scheduling

1. Set projects at their due dates
2. Select the drum resource(s)
3. Collect drum resource tasks
4. Resolve drum contention
5. Reschedule projects
6. Make necessary adjustments



Integrity - Service - Excellence

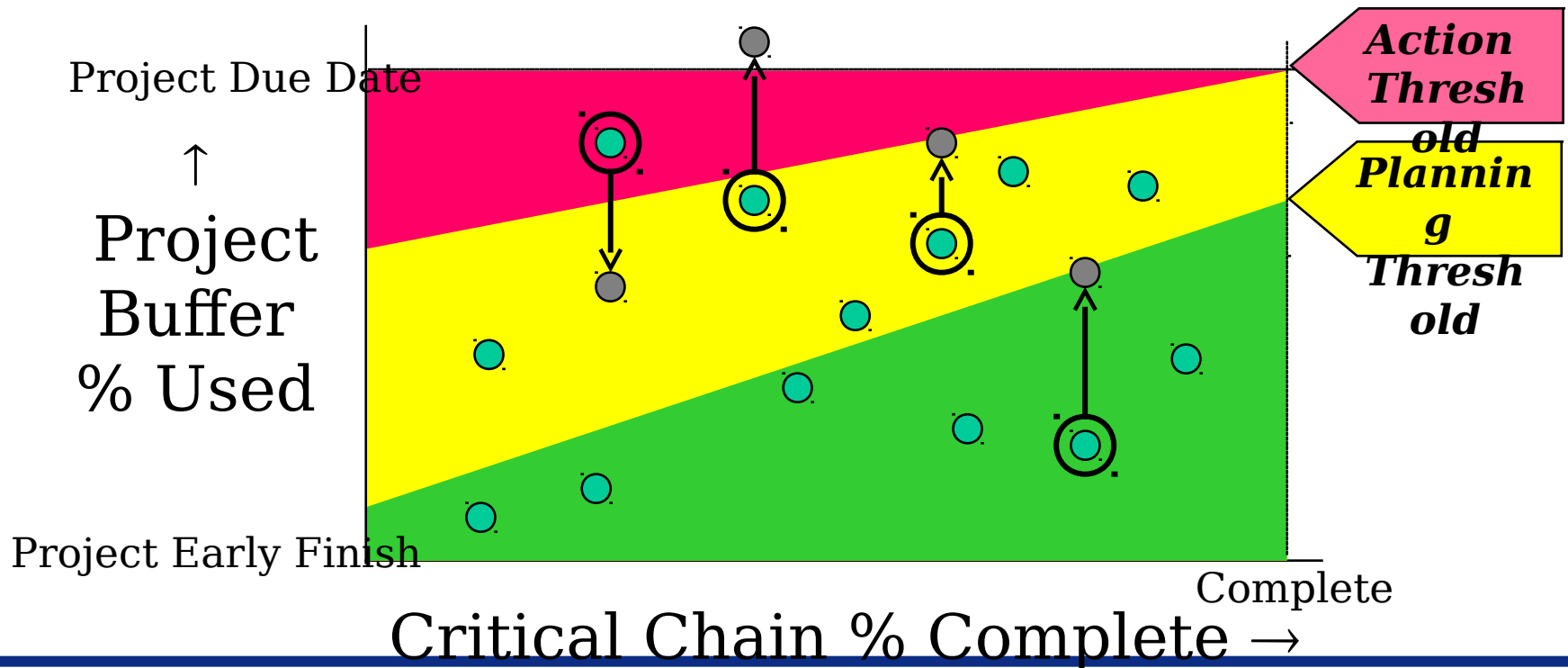


U.S. AIR FORCE

Executive Decision Support

Multi-project CCPM

- *Provides leaders information on status of ALL projects*
- *Allows trade-offs between projects*



Integrity - Service - Excellence